

# APSM 152A: PIPING, REFRIGERANT EVACUATION & RECOVERY

## Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	1.5
Hours:	12 lecture, 28 laboratory per quarter (40 total per quarter)
Prerequisite:	Per California Code of Regulations, this course is limited to students admitted to the Sheet Metal Apprenticeship Program.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	None
Grade Type:	Letter Grade Only
Repeatability:	Not Repeatable

## Student Learning Outcomes

- A successful student will be able to safely bend, cut, assemble and solder or braze common small diameter copper piping associated with air conditioning systems.
- A successful student will be able to demonstrate standing pressure testing and leak detection procedures for air conditioning piping.

## Description

Students are introduced to the materials and types of connections used in HVAC piping. Students learn how to safely evacuate and recover HVAC refrigerants.

## Course Objectives

The student will be able to:

- List the various types of piping associated with heating and air conditioning
- Demonstrate the ability to measure, cut, bend, and make various types of tubing and piping connections
- Demonstrate the safe use of soldering and brazing equipment
- List proper evacuation practices
- Demonstrate standing pressure testing and leak detection procedures
- Demonstrate use of recovery equipment

## Course Content

- List the various types of piping associated with heating and air conditioning
  - List the different types of tubing used in heating and air conditioning operations (Lec and Lab)
- Demonstrate the ability to measure, cut, bend, and make various types of tubing and piping connections

- Describe two ways of cutting copper tubing (Lec and Lab)
  - List procedures for bending tubing (Lec and Lab)
- Ability to braze and solder (Lec and Lab)
  - Make flared joints (Lec and Lab)
  - Swage joints (Lec and Lab)
  - Prepare and thread steel pipe (Lec and Lab)
- List four types of plastic pipe and describe uses for each (Lec and Lab)
  - Describe alternative methods of connecting pipe (Lec and Lab)
- Demonstrate the safe use of soldering and brazing equipment
    - Pass written safety test on use of soldering and brazing equipment (Lec and Lab)
    - Explain and demonstrate proper use of gas torches for safe operation (Lec and Lab)
  - List proper evacuation practices
    - List some of the proper evacuation practices (Lec and Lab)
    - Describe two different types of evacuation (Lec and Lab)
    - Describe two different types of vacuum measuring devices (Lec and Lab)
    - Choose a proper high-vacuum pump (Lec and Lab)
    - Describe a high-vacuum single evacuation (Lec and Lab)
    - Describe a triple evacuation (Lec and Lab)
  - Demonstrate standing pressure testing and leak detection procedures
    - Describe a standing pressure test (Lec and Lab)
    - Choose a leak detector for a particular type of leak (Lec and Lab)
  - Demonstrate use of recovery equipment
    - Review EPA regulations regarding recovery of refrigerants and recovery equipment (Lec and Lab)
    - Demonstrate use of recovery equipment (Lec and Lab)

## Lab Content

- Demonstrate proper evacuation of HVAC refrigerant
- Demonstrate proper recovery of HVAC refrigerant

## Special Facilities and/or Equipment

- Laboratory with sheet metal service tools
- Personal protective equipment
- When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address

## Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Results of written quizzes and tests  
Responses in class discussions  
Comprehensive written final examination  
Demonstration of assigned skills to acceptable level per instructor

## Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture  
Discussion

Demonstration

Lab assignments followed by discussion

## **Representative Text(s) and Other Materials**

Whitman, B., B. Johnson, J. Tomczyk, and E. Silberstein. Refrigeration and Air Conditioning Technology, 8th ed.. 2016.

Auvil, Ronnie J.. HVAC Controls Systems, 4th ed.. 2017.

These are the standard sheet metal textbooks/workbooks used for this course. Although one or more may not be within five years of the required published date, they are the most current books used when teaching this course.

## **Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments**

- a. Sample reading assignment: From the Refrigeration and Air Conditioning Technology textbook, Unit 7, "Tubing and piping"
- b. Sample writing assignment: Complete review questions related to assigned reading

## **Discipline(s)**

Sheet Metal or Air Conditioning, Refrigeration, Heating